Welcome to

Science at Home

The U.S. Department of Energy provided funds to enable the Science Education and Outreach Office at Los Alamos National Laboratory to develop, test, and disseminate Science at Home.

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What is Science at Home?

Science at Home is a book of fun, easy-to-do science activities that involves parents and children in the exciting process of science through experiments that can be performed at home with common household materials.

Science at Home is more than just another activity book; it is the central component of a school and community partnership program. The focus of this partnership being a parent-teacher team that coordinates *Science at Home* workshops at their school or other community organizations. Through these teams, families are introduced to *Science at Home* and how to model science exploration.

Science at Home will make it easier for parents and children to learn the skills they will need to successfully conduct, analyze, and report an experiment. *Science at Home* is a hands-on, mind-on science program. *Science at Home* emphasizes that learning science is something that you do, not something that is done to you. *Science at Home* is age appropriate and fills the needs for both young and old, big and little. *Science at Home* is families working together, sharing ideas and having fun.

The goals of *Science at Home* were established to:

- demystify science,
- foster habits of scientific inquiry and analysis,
- improve the capacity of parents and children to use science process skills,
- raise the confidence of children in their ability to learn and practice science,
- foster science literacy among children and their parents by exposing them to basic science concepts and skills,
- encourage the development of cooperative learning skills among children and their parents.

The activities in *Science at Home* follow a format designed to enhance the learning process. Every activity begins with an **introductory section** and a list of "**The Stuff You'll Need"**. The second section, **"Here's the Plan",** provides directions for completing the activity. The **"Wrap-up"** section brings the activity to closure while the next section, **"What's Going On Here?"**, explains the science behind the activity. The section entitled, **"Where Does This Happen In Real Life?"** makes connections with real world applications of the concept. Finally, the section, **"Now Try This"** provides a groundwork for continuing the exploration process.

The following activity is one example of the many physical science activities designed to help parents and children discover science. Have fun exploring and discovering the wonderful world of *Science at Home*.

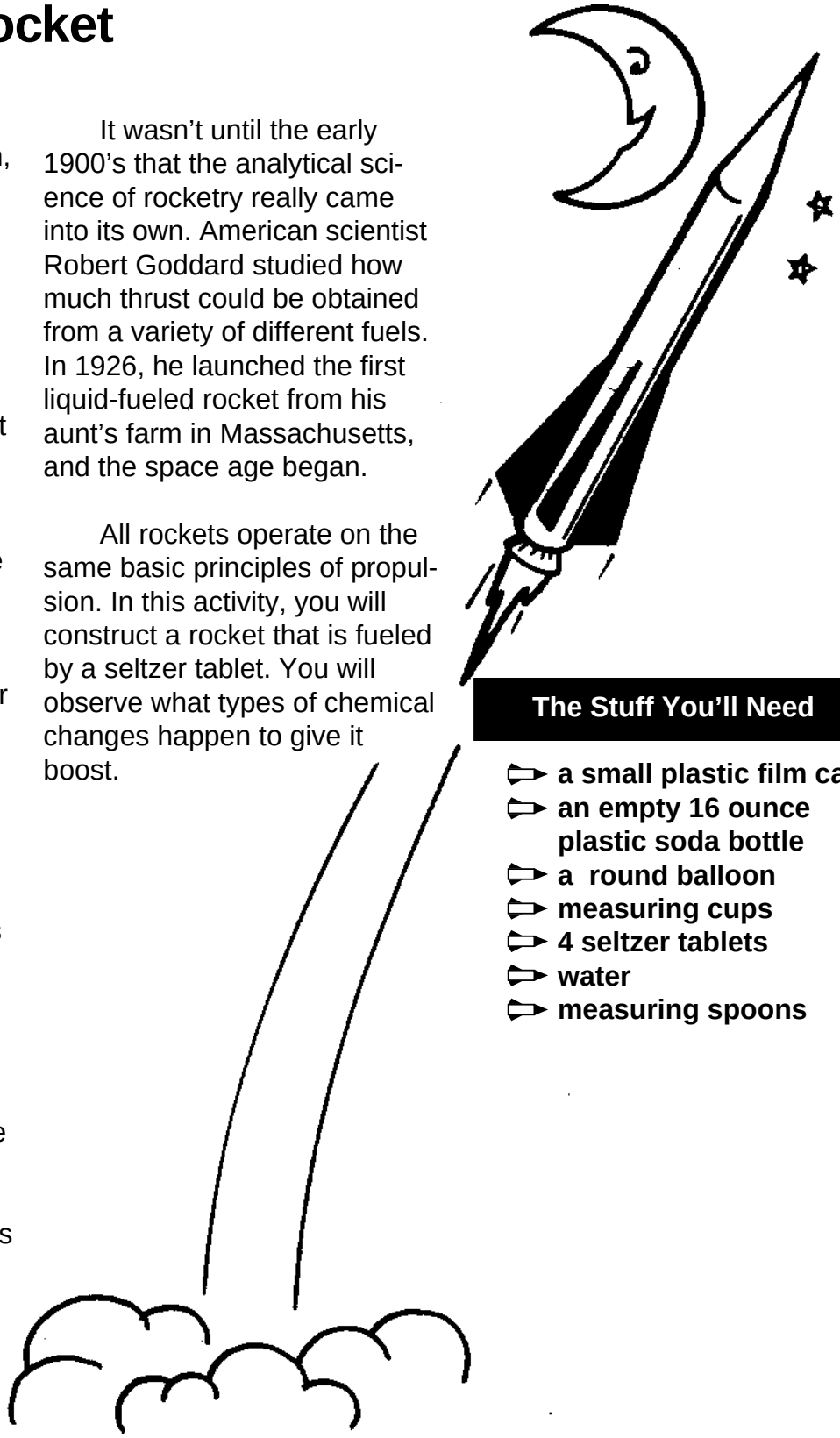
Seltzer Tablet Rocket

5...4...3...2...1...liftoff! As the solid rocket boosters kick in, the Space Shuttle Atlantis slowly lifts it's 2 million kilograms off the launch pad and another mission is underway. Today, rockets with enormous payloads are commonly launched, but less than 60 years ago, most people thought rockets even close to this size existed only in science fiction.

Historians aren't quite sure who invented the first rocket, but by the year 1250 AD, Chinese warriors were launching simple bombs using gunpowder for **propulsion**. For over 500 years, these simple rockets were used only for military purposes. They were crude, had no steering mechanism, and often blew up before they even got off the ground. Things started to improve in the early 1800's, however, when William Congreve, an English scientist, added a simple guidance system to his gunpowder fired rockets. With the addition of the first real launching pad, his "rockets' red glare" during the War of 1812 were made famous in the "Star Spangled Banner," the National Anthem of the United States.

It wasn't until the early 1900's that the analytical science of rocketry really came into its own. American scientist Robert Goddard studied how much thrust could be obtained from a variety of different fuels. In 1926, he launched the first liquid-fueled rocket from his aunt's farm in Massachusetts, and the space age began.

All rockets operate on the same basic principles of propulsion. In this activity, you will construct a rocket that is fueled by a seltzer tablet. You will observe what types of chemical changes happen to give it boost.



The Stuff You'll Need

- **a small plastic film can**
- **an empty 16 ounce plastic soda bottle**
- **a round balloon**
- **measuring cups**
- **4 seltzer tablets**
- **water**
- **measuring spoons**

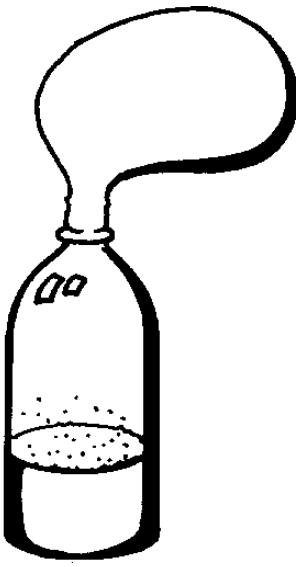
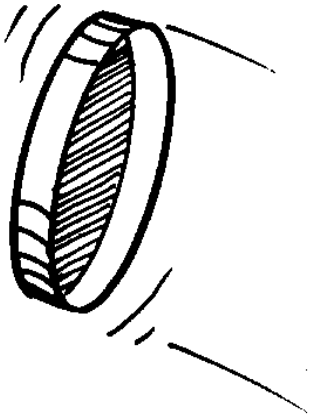


diagram 1



Here's The Plan

1. Pour a tablespoon of water into a film can.

2. Drop a 1/2 seltzer tablet into the water. What happened when you dropped the tablet in the water? What did you hear and see? Place your palm over the top of the can, what do you feel?

3. Break up two seltzer tablets and place them into the soda bottle.

4. Pour 1/4 cup of water into the bottle and quickly put the opening of the balloon over the top of the bottle (diagram 1). Swish the contents of the bottle around several times and observe what happens to the balloon.

5. Pour the water and seltzer in the film can down the drain.

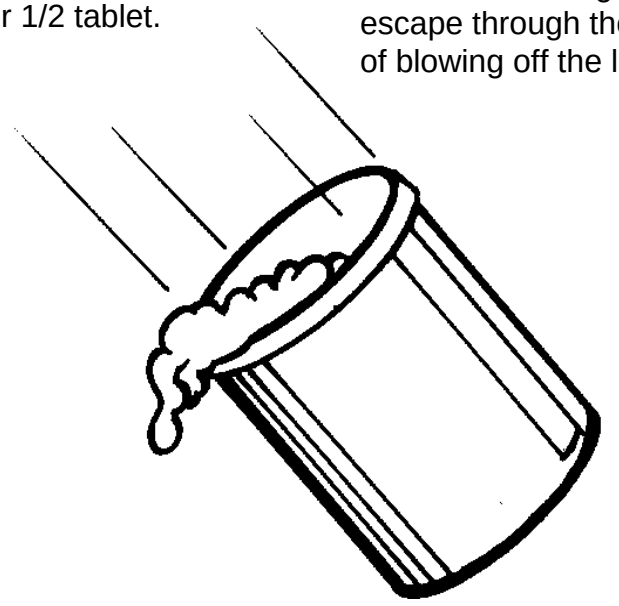
6. Pour another tablespoon of water into the film can and drop in another 1/2 tablet.

7. Snap the lid on tight, and stand back! Observe what happens.

8. What happened to the balloon when you placed it over the top of the bottle? Why do you think this happened? What happened to the lid of the film can? Why do you think it happened? What do you think would happen if you punched a small hole in the film can lid with a pin?

Wrap-Up

When you added the seltzer tablets to water, a chemical reaction took place producing gas bubbles. You could hear the gas fizzing in both the open film can and the bottle. It was the gas from the seltzer that blew up the balloon and it was the pressure of this gas that popped the top of the film can. If you punched a hole in the lid of the film can, the gas would escape through the hole instead of blowing off the lid.



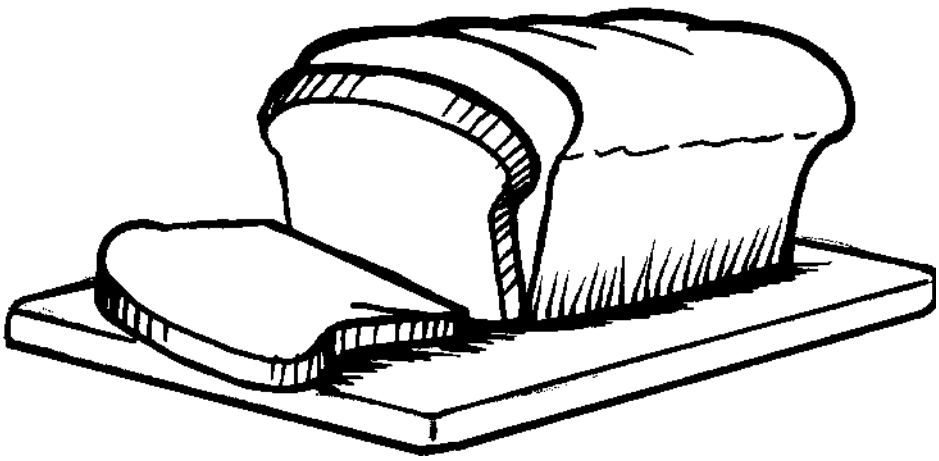
What's Going On Here?

When a seltzer tablet dissolves in water, a chemical change takes place and carbon dioxide gas (CO_2) is formed. Most seltzer tablets contain a base called sodium bicarbonate (baking soda) and dehydrated citric acid. When the tablet is dropped in the water, the citric acid combines with the baking soda. Acids and bases undergo a chemical reaction when they mix, producing a gas and salt.

In the closed can the newly created gas has no place to go, since the film can is already full of air. This is like trying to add more air to a balloon that is already full. The pressure inside the film can eventually blows the lid off. This is the same thing that happens when you open a can of soda. You notice the fizz that it makes. The carbon dioxide rushes out, making a *whoosh* sound.

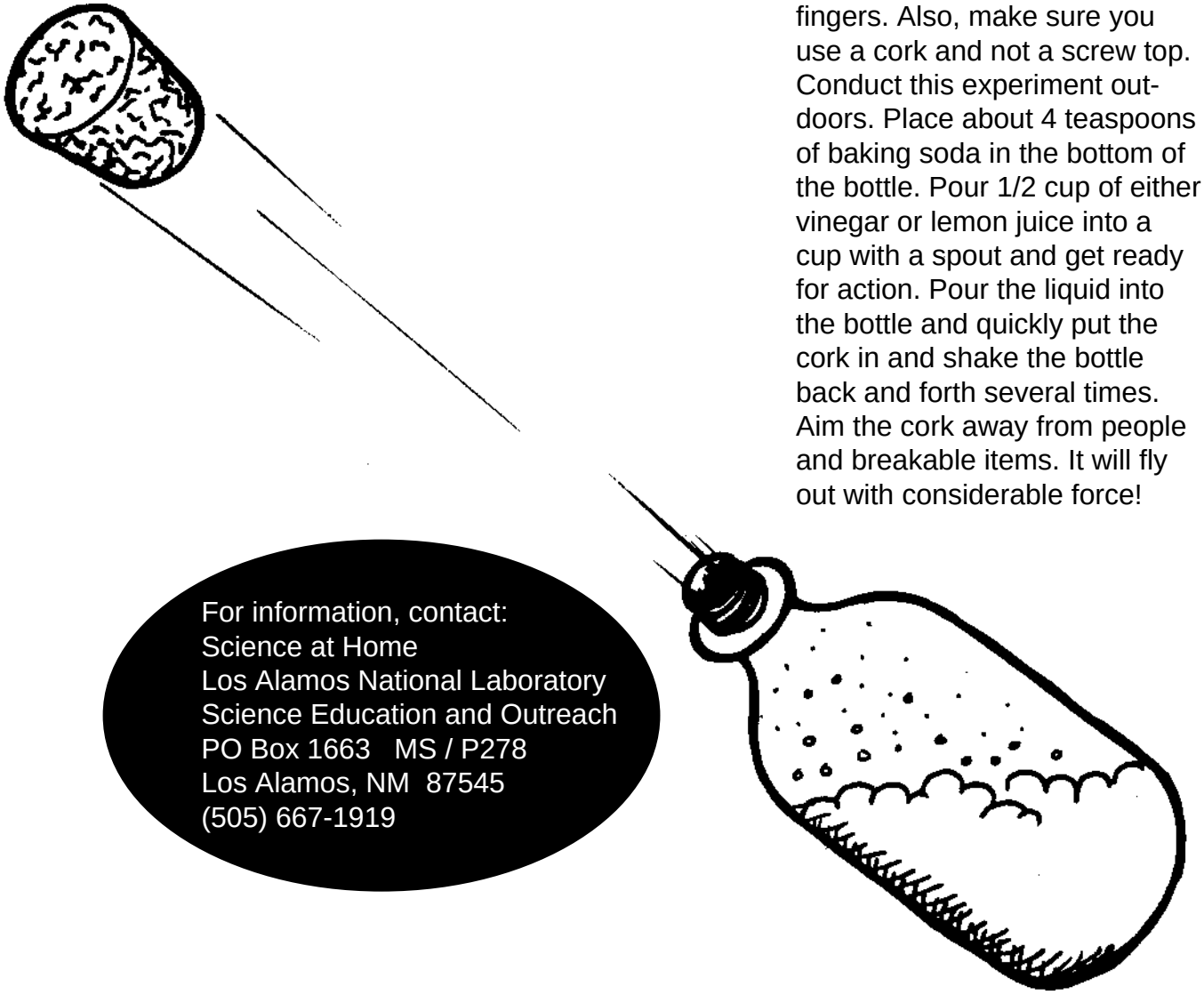
Where Does This Happen In Real Life?

Carbon dioxide is used in many products, from fire extinguishers to soda pop, and it is the by-product of many different chemical reactions including the burning of things like wood, paper, coal, and oil. When bakers make bread, they add yeast to the dough. Yeast is living organisms that feed on the sugar in the dough, converting it to energy and carbon dioxide. As the carbon dioxide tries to escape, it pushes the dough up making it fluffy. We say the dough rises, but it's really getting pumped up by the carbon dioxide gas. Yeast takes a while to get going, so to get a quick rise out of the bread or cake, bakers use baking powder. It has the same effect as yeast, but it works in a fraction of the time.



Now Try This

Your film can rocket makes a pleasant pop, but if you want to move up to the big time blasters, you'll need an empty plastic soda bottle (1 liter is best but 2 liters will work), a cork, some baking soda, and either vinegar or lemon juice. Before starting, make sure the bottle is clean and dry, and make sure the cork fits snugly in the bottle opening, but loosely enough that you can pull it out with your fingers. Also, make sure you use a cork and not a screw top. Conduct this experiment outdoors. Place about 4 teaspoons of baking soda in the bottom of the bottle. Pour 1/2 cup of either vinegar or lemon juice into a cup with a spout and get ready for action. Pour the liquid into the bottle and quickly put the cork in and shake the bottle back and forth several times. Aim the cork away from people and breakable items. It will fly out with considerable force!



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